WHAT IS CLAIMED IS:

1. A semiconductor device comprising:

an Si semiconductor substrate;

an insulating film having an opening formed in the Si semiconductor substrate;

a first single crystal layer disposed in the opening; and

a second single crystal layer formed on the first single crystal layer;

wherein the first single crystal layer and the second single crystal layer each comprises a single crystal (SiGe)C layer having one or both of Si and Ge, and C as essential constituent ingredients, and a stoichiometric ratio of the sum of Si and Ge to C being about 1:1, and a forbidden band width of the first single crystal layer is different from that of the second crystal layer.

2. A semiconductor device comprising:

an Si semiconductor substrate;

an insulating film having an opening formed in the Si semiconductor substrate;

a first single crystal layer disposed in the opening;

a second single crystal layer formed on the first single crystal layer; and

a third single crystal layer formed on the second

single crystal layer;

wherein the first single crystal layer, the second single crystal layer, and the third single crystal layer each comprises a single crystal (SiGe)C layer having one or both of Si and Ge, and C as essential constituent ingredients, and a stoichiometric ratio of the sum of Si and Ge to C being about 1:1, and a forbidden band width of at least one of the first single crystal layer, the second single crystal layer, and the third single crystal layer is different from those of the other layers.

3. A semiconductor device according to claim 2, wherein a conduction type of the second single crystal layer is different from that of the third single crystal layer.

4. A semiconductor device according to claim 3, wherein a forbidden band width of the second crystal layer is smaller than that of the third crystal layer.

5. A semiconductor device according to claim 1 wherein a gate electrode is present on the second single crystal layer, a channel layer through which current flows is formed at a portion facing the gate electrode in one or both of the first single crystal layer and the second single crystal layer, and a source region and a drain region are formed in a main surface of a hetero junction portion formed of the first single crystal layer and the second single crystal layer so as to make electric contact with the channel layer.

6. A semiconductor device according to claim 5, wherein the channel layer is formed in one, having a smaller forbidden band width, of the first single crystal layer and the second single crystal layer and the other having a larger forbidden band width is formed as a barrier layer above the channel layer, and the gate electrode is present above the barrier layer.

7. A semiconductor device comprising:

an Si semiconductor substrate;

an insulating film having an opening formed on Si semiconductor substrate;

a layered structure including one or both of the first single crystal layer formed in the opening and the second single crystal layer formed on the first single crystal layer;

a gate electrode formed on the second single crystal layer,

a channel region formed at a portion facing the gate electrode in one or both of the first single crystal layer and the second single crystal layer; and

a source region and a drain region interposing the gate electrode therebetween.

8. A semiconductor device according to claim 7, wherein the first single crystal layer and a second single crystal layer each comprises a single crystal (SiGe)C layer having a stoichiometric ratio of the sum of Si and Ge to C being about

1:1.

9. A semiconductor device according to claim 8, wherein an SiGeC layer comprising one or both of Si and Ge, and C as essential constituent ingredients is present between the Si semiconductor substrate and the first single crystal layer, and a lattice constant of the Si semiconductor substrate is different from that of the first single crystal layer.

10. A semiconductor device according to claim 1, wherein a plane orientation of the Si semiconductor substrate is (100).

11. A semiconductor integrated circuit device comprising:

a semiconductor device, said semiconductor device including:

an Si semiconductor substrate;

a first semiconductor device comprising:

an insulating film having an opening formed in the Si semiconductor substrate;

a first single crystal layer disposed in the opening; and

a second single crystal layer formed on the first single crystal layer;

wherein the first single crystal layer and the second single crystal layer each comprises a single crystal (SiGe)C layer having one or both of Si and Ge, and C as

essential constituent ingredients, and a stoichiometric ratio of the sum of Si and Ge to C being about 1:1, and a forbidden band width of the first single crystal layer is different from that of the second crystal layer; and

a second semiconductor device using Si for an operation active layer.

12. A semiconductor circuit module at least having a semiconductor device, said semiconductor device comprising:

an Si semiconductor substrate;

an insulating film having an opening formed in the Si semiconductor substrate;

a first single crystal layer disposed in the opening; and

a second single crystal layer formed on the first single crystal layer;

wherein the first single crystal layer and the second single crystal layer each comprises a single crystal (SiGe)C layer having one or both of Si and Ge, and C as essential constituent ingredients, and a stoichiometric ratio of the sum of Si and Ge to C being about 1:1, and a forbidden band width of the first single crystal layer is different from that of the second crystal layer.

13. A method of manufacturing a semiconductor device comprising the steps of:

forming an insulating film having an opening on an Si

semiconductor substrate;

forming a first single crystal layer in the opening; and

forming a second single crystal layer on the first single crystal layer;

wherein the first single crystal layer and the second single crystal layer each has a single crystal (SiGe)C layer comprising one or both of Si, Ge, and C as essential constituent ingredients, and having a stoichiometric ratio of the sum of Si and Ge, and C being about 1:1, and a forbidden band width of the first single crystal layer is different from that of second single crystal layer.

14. A method of manufacturing a semiconductor device comprising the steps of:

forming an insulating film having an opening on an Si semiconductor substrate;

forming a first single crystal layer in the opening;

forming a second single crystal layer on the first single crystal layer; and

forming a third single crystal layer on the second single crystal layer;

wherein the first single crystal layer, the second single crystal layer, and the third single crystal layer each has a single crystal (SiGe)C layer comprising one or both of Si, Ge, and C as essential constituent ingredients, and having

a stoichiometric ratio of the sum for Si and Ge to C being about 1:1, and a forbidden band width of at least one of the first single crystal layer, the second single crystal layer, and the third single crystal layer is different from those of the other layers.

15. A method of manufacturing a semiconductor device according to claim 14, wherein in the steps of forming the first single crystal layer and forming the second single crystal layer, a starting gas contains an organic compound gas having an Si atom-C atom bond, or both of an organic compound gas having an Si atom-C atom bond and an organic compound gas having a Ge atom-C atom bond.

16. A method of manufacturing a semiconductor device according to claim 14, wherein in the steps of forming the first single crystal layer and forming the second single crystal layer, a starting gas contains an organic gas having an Si atom-C atom bond.

17. A method of manufacturing a semiconductor device according to claim 14, wherein in the steps of forming the first single crystal layer and forming the second single crystal layer, a starting gas contains an organic gas having a Ge atom-C atom bond.